

## WHAT IS CLAIMED IS:

1           1.    For use in wireless network communications system  
2           comprising a plurality of base stations and a plurality of  
3           mobile stations, an apparatus for determining a distance  
4           from a base station to a mobile station, said apparatus  
5           comprising:

6                a distance unit associated with said base station  
7           wherein said distance unit is capable of determining a one  
8           way travel time  $D$  of a signal from said base station to  
9           said mobile station; and

10           wherein said distance unit is capable of multiplying  
11           said one way travel time  $D$  by the speed of light to obtain  
12           said distance from said base station to said mobile  
13           station.

1           2.    The apparatus as set forth in Claim 1 wherein  
2    said distance unit is capable of determining said one way  
3    travel time D from:

$$4 \qquad D = \frac{1}{2} [ (two\ way\ travel\ time) - (random\ backoff) ]$$

5           wherein said two way travel time is a time of travel  
6    for a range signal to travel from said base station to said  
7    mobile station and to travel from said mobile station to  
8    said base station; and

9           wherein said random backoff is a time value of a chip  
10   length of a random backoff parameter of said mobile  
11   station.

1           3.    The apparatus as set forth in Claim 2 wherein  
2    said distance unit is capable of obtaining said two way  
3    travel time by subtracting an arrival time of said range  
4    signal at said base station from said mobile station from a  
5    transmission time of said range signal from said base  
6    station to said mobile station.

1           4.    The apparatus as set forth in Claim 2 wherein  
2    said random backoff parameter for said mobile station has a  
3    chip length value between zero chip lengths and five  
4    hundred eleven chip lengths.

1           5.    The apparatus as set forth in Claim 4 wherein a  
2    time value for one chip length value is eight hundred  
3    thirteen and eight tenths nanoseconds.

1           6.    The apparatus as set forth in Claim 1 wherein  
2    said distance unit is capable of obtaining a distance from  
3    said base station to said mobile station with a distance  
4    resolution of approximately two hundred forty four meters.

1           7.    The apparatus as set forth in Claim 2 wherein  
2    said distance unit is capable of adjusting a value of said  
3    two way travel time to correct a time difference of a  
4    signal comprising one of: a multipath signal and a Doppler  
5    shifted signal.

1           8.    A    wireless    network    communications    system  
2    comprising a base station and a mobile station, said base  
3    station comprising an apparatus for determining a distance  
4    from said base station to said mobile station, said  
5    apparatus comprising:

6           a distance unit associated with said base station  
7    wherein said distance unit is capable of determining a one  
8    way travel time  $D$  of a signal from said base station to  
9    said mobile station; and

10           wherein said distance unit is capable of multiplying  
11   said one way travel time  $D$  by the speed of light to obtain  
12   said distance from said base station to said mobile  
13   station.

1           9.    The wireless network communications system as set  
2    forth in Claim 8 wherein said distance unit is capable of  
3    determining said one way travel time D from:

$$D = \frac{1}{2} [ (two\ way\ travel\ time) - (random\ backoff) ]$$

5           wherein said two way travel time is a time of travel  
6    for a range signal to travel from said base station to said  
7    mobile station and to travel from said mobile station to  
8    said base station; and

9           wherein said random backoff is a time value of a chip  
10   length of a random backoff parameter of said mobile  
11   station.

1           10.   The wireless network communications system as set  
2    forth in Claim 9 wherein said distance unit is capable of  
3    obtaining said two way travel time by subtracting an  
4    arrival time of said range signal at said base station from  
5    said mobile station from a transmission time of said range  
6    signal from said base station to said mobile station.

1           11. The wireless network communications system as set  
2           forth in Claim 9 wherein said random backoff parameter for  
3           said mobile station has a chip length value between zero  
4           chip lengths and five hundred eleven chip lengths.

1           12. The wireless network communications system as set  
2           forth in Claim 11 wherein a time value for one chip length  
3           value is eight hundred thirteen and eight tenths  
4           nanoseconds.

1           13. The wireless network communications system as set  
2           forth in Claim 8 wherein said distance unit is capable of  
3           obtaining a distance from said base station to said mobile  
4           station with a distance resolution of approximately two  
5           hundred forty four meters.

1           14. The wireless network communications system as set  
2           forth in Claim 9 wherein said distance unit is capable of  
3           adjusting a value of said two way travel time to correct a  
4           time difference of a signal comprising one of: a multipath  
5           signal and a Doppler shifted signal.

1           15. For use in wireless network communications system  
2           comprising a base station and a mobile station, a method of  
3           determining a distance from said base station to said  
4           mobile station comprising the steps of:

5           determining with a distance unit associated with said  
6           base station a one way travel time D of a signal from said  
7           base station to said mobile station; and

8           multiplying said one way travel time D by the speed of  
9           light to obtain said distance from said base station to  
10          said mobile station.

1           16. The method as set forth in Claim 15 wherein the  
2           step of determining with a distance unit associated with  
3           said base station a one way travel time D of a signal from  
4           said base station to said mobile station comprises the step  
5           of:

6           calculating said one way travel time D from:

7           
$$D = \frac{1}{2} [ (two\ way\ travel\ time) - (random\ backoff) ]$$

8           wherein said two way travel time is a time of travel  
9           for a range signal to travel from said base station to said  
10          mobile station and to travel from said mobile station to  
11          said base station; and

12          wherein said random backoff is a time value of a chip  
13          length of a random backoff parameter of said mobile  
14          station.

1           17. The method as set forth in Claim 16 further  
2           comprising the step of:

3           obtaining said two way travel time by subtracting an  
4           arrival time of said range signal at said base station from  
5           said mobile station from a transmission time of said range  
6           signal from said base station to said mobile station.



1           18. The method as set forth in Claim 16 wherein said  
2 random backoff parameter for said mobile station has a chip  
3 length value between zero chip lengths and five hundred  
4 eleven chip lengths.

1           19. The method as set forth in Claim 18 wherein a  
2 time value for one chip length value is eight hundred  
3 thirteen and eight tenths nanoseconds.

1           20. The method as set forth in Claim 15 further  
2 comprising the step of:

3           obtaining with said distance unit a distance from said  
4 base station to said mobile station with a distance  
5 resolution of approximately two hundred forty four meters.

1           21. The method as set forth in Claim 16 further  
2 comprising the step of:

3           adjusting in said distance unit a value of said two  
4 way travel time to correct a time difference of a signal  
5 comprising one of: a multipath signal and a Doppler shifted  
6 signal.

1           22. The method as set forth in Claim 15 wherein said  
2 distance unit determines a distance from said base station  
3 to said mobile station in less than ten seconds.

1           23. For use in wireless network communications system  
2 comprising a plurality of base stations and a plurality of  
3 mobile stations, a method for locating a mobile station in  
4 an area between three base stations, said method comprising  
5 the steps of:

6           determining with a distance unit associated with each  
7 of said three base stations a one way travel time D of a  
8 signal from each respective station to said mobile station  
9 where

10           
$$D = \frac{1}{2} [ (two\ way\ travel\ time) - (random\ backoff) ]$$

11           wherein said two way travel time is a time of travel  
12 for a range signal to travel from each respective base  
13 station to said mobile station and to travel from said  
14 mobile station to each respective base station;

15           wherein said random backoff is a time value of a chip  
16 length of a random backoff parameter of said mobile  
17 station;

18           multiplying each respective one way travel time D by  
19 the speed of light to obtain each respective distance from  
20 each respective base station to said mobile station; and

21           identifying a location of said mobile station within  
22 said area between said three base stations using said

23        respective distances of said mobile station from said  
24        respective base stations.

1            24. The method as set forth in Claim 23 wherein said  
2        location of said mobile station within said area between  
3        said three base stations has a distance resolution of  
4        approximately two hundred forty four meters.

1            25. The method as set forth in Claim 23 wherein the  
2        step of identifying said location of said mobile station  
3        within said area between said three base stations using  
4        said respective distances of said mobile station from said  
5        respective base stations comprises the steps of:

6            providing said respective distances of said mobile  
7        station from said respective base stations to a distance  
8        unit within one of said three base stations; and

9            calculating in said distance unit a location of said  
10        mobile station from said respective distances of said  
11        mobile station from said respective base stations.

1           26. The method as set forth in Claim 23 wherein the  
2       step of identifying said location of said mobile station  
3       within said area between said three base stations using  
4       said respective distances of said mobile station from said  
5       respective base stations comprises the steps of:

6           providing said respective distances of said mobile  
7       station from said respective base stations to a calculator  
8       unit not located within said three base stations; and

9           calculating in said calculator unit a location of said  
10      mobile station from said respective distances of said  
11      mobile station from said respective base stations.

1           27. For use in wireless network communications system  
2           comprising a plurality of base stations and a plurality of  
3           mobile stations, an apparatus for locating a mobile station  
4           in an area between three base stations, said apparatus  
5           comprising:

6           a distance unit associated with each of said three  
7           base stations wherein said distance unit is capable of  
8           determining a one way travel time D of a signal from each  
9           respective station to said mobile station where

10           
$$D = \frac{1}{2} [ (two\ way\ travel\ time) - (random\ backoff) ]$$

11           wherein said two way travel time is a time of travel  
12           for a range signal to travel from each respective base  
13           station to said mobile station and to travel from said  
14           mobile station to each respective base station;

15           wherein said random backoff is a time value of a chip  
16           length of a random backoff parameter of said mobile  
17           station;

18           wherein said distance unit is capable of multiplying  
19           each respective one way travel time D by the speed of light  
20           to obtain each respective distance from each respective  
21           base station to said mobile station; and

22 wherein said distance unit is capable of identifying a  
23 location of said mobile station within said area between  
24 said three base stations using said respective distances of  
25 said mobile station from said respective base stations.

1 28. The apparatus as set forth in Claim 27 wherein  
2 said location of said mobile station within said area  
3 between said three base stations has a distance resolution  
4 of approximately two hundred forty four meters.

1 29. The apparatus as set forth in Claim 27 wherein  
2 said distance unit is capable of calculating a location of  
3 said mobile station from said respective distances of said  
4 mobile station from said respective base stations.

1           30. The apparatus as set forth in Claim 27 further  
2 comprising:

3           a calculator unit coupled to said three base stations  
4 but not located within said three base stations, said  
5 calculator unit capable of receiving from said three base  
6 stations said respective distances of said mobile station  
7 from said respective base stations;

8           wherein said calculator unit is capable of calculating  
9 a location of said mobile station from said respective  
10 distances of said mobile station from said respective base  
11 stations.